PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-042295
(43)Date of publication of application : 13.02.1998

(51)Int.Cl. H04N 7/32

(21)Application number : 08-191266
(22)Date of filing : 19.07.1996

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(54) VIDEO SIGNAL ENCODING METHOD AND VIDEO SIGNAL ENCODER

(57)Abstract:
PROBLEM TO BE SOLVED: To satisfy the frame rate of an MPEG standard and to reduce a practical frame rate.
SOLUTION: A copy stream generator 19 for generating a code word bit stream (copy stream) for indicating that it is the same as a previously encoded picture is provided. A system control part 15 supplies the code word bit stream (copy stream) 19a outputted from the copy stream generator 19 through an output data changeover switch 16 for comprising a code multiplexer to a butter 7 without performing inter motion compensation frame encoding to a B picture or a P picture to be the object of frame thinning. By inserting the code word but stream of just copying a frame in front or at the back cyclicallythe frame rate lower than a normal frame rate is realized.

CLAIMS

[Claim(s)]
[Claim 1]A video signal encoding method generating a frame signal which shows that a frame is an identical image signal in a video signal encoding method which generates a digital encoded signal coded by inter frame predictionand inserting in a bit stream.
[Claim 2]A coding video signal device provided with a frame copying means which generates a frame signal which shows that a frame is an identical image signal in a coding video signal device which generates a digital encoded signal coded by inter frame predictionand is inserted in a bit stream.
[Claim 3]The coding video signal device according to claim 2 constituting said frame copying means from a copy stream generator which generates a code word bit stream set up beforehand.
[Claim 4]The coding video signal device according to claim 2 constituting said frame copying means from a switching means which makes zero compulsorily a

quantization output of a motion vector and a quantizer.
[Claim 5]The coding video signal device according to claim 2wherein said digital encoded signal is a signal of an MPEG standard.
[Claim 6]The coding video signal device according to claim 5wherein a frame copied by said frame copying means is B picture.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to a video signal encoding method and a coding video signal deviceand in detailAfter it is satisfied with inserting the data which specifies the copy of a frame into a bit stream of the conditions of the frame rate on a standardit is related with the video signal encoding method and coding video signal device which enable reduction of a substantial frame rate.
[0002]
[Description of the Prior Art]MPEG1 (ISO/IEC11172) is known as one of the video coding modes for storage media (MPEG:Moving Picture Experts Group). The data structure of MPEG1 is shown in drawing 1and the bit stream structure of MPEG1 is shown in drawing 2 - drawing 7. Drawing 1 - drawing 7 are indicated to the Yasuda ****** "international standards of multimedia" (Maruzen issue) of Chapter 6. These data structures and bit stream structure are related with a standardization proposal.
[0003]As shown in drawing 1MPEG1 has a blocka macro blocka slicea pictureGOPand a data structure of six layers of a sequence.
[0004]A block comprises a pixel of 8 pixels x eight lines which luminosity or color difference adjoined. DCT (discrete cosine transform) is performed by this block unit.
[0005]A macro block comprises six blocks with right and left and four luminosity blocks Y0 which adjoined each other up and downY1Y2Y3and the color difference block Cb and Cr that correspond to the same position on a picture. Transmitting order is Y0Y1Y2Y3Cband Cr. It is judged by a macro block unit whether it is necessary what is used for prediction data (image data of the standard which takes difference: made from forward predictionbackward predictionboth-directions predictionetc.)or to send difference. When a coding block is the same as a prediction macro blockno data of a macro block layer is sent. It is said that this is skipped. When a macro block is skipped continuouslythe number of the skipped macro blocks before that is given to the non-skip macro block which comes to the next.
[0006]A slice comprises 1 or two or more macro blocks which stand in a row in the operation order of a picture. In the head of a slicethe motion vector within a picture and the difference of a DC component are reset. The first macro block has data in which the position within a picture is shownand even when an error takes

placeit enables it to return. The length of a slice and the starting position are arbitrary. The macro block of the beginning of a slice and the last must be a non-skip macro block.
[0007]A picture (picture in every sheet) comprises at least 1 or two or more slices. A picture is classified into three kinds of picture typesIPand Baccording to the method coded.
[0008]When codedonly the information closed only in the one picture is used for I picture (Intra-coded picture: intra coded image). In other wordswhen decryptinga picture can be reconstructed only for the information on I picture itself.
[0009]I picture or P picture which was located before in time and was already decrypted in the input is used for P picture (Predictive-coded picture: forward prediction coded image) as an estimated image (picture used as the standard which takes difference). the ** which codes a difference with the estimated image by which the motion compensation was carried out actuallyor does not take difference -- coding (intra coding) -- the more efficient one can be chosen by a macro block unit.
[0010]B picture (Bidirection predictive-codedpicture: both-directions prediction-coding picture)Three kinds of interpolation pictures made from I picture which was located before in time and was already decrypted or P pictureI picture which was located behind in time and was already decrypted or P pictureand its both are used as an estimated image. What has the best efficiency can be chosen by a macro block unit in coding of the difference after three kinds of this motion compensationand intra coding.
[0011]GOP (glue PUOBU picture) comprises 1I picture of two or more sheets and 0or an un-I picture of two or more sheets. When entry sequenced to an encoder is set to I1B-2B3P4|B5B6I7B8B9I10B11B12P13B14B15P16|B17B18I19B20B21and P21The output of an encoder is set to I1P4B-2B3|I7B5B6I10B8B9P13B11B12P16B14B15|I19I7B18P21B20and B21. HereIPand B express a picture typea number expresses the entry sequenced foreword to an encoderand | expresses the end eye of GOP. since I picture which is back in time or P picture used as the estimated image needs to be first coded in order to code or decrypt B picturea frame is located in a line in an encoder -- changing (exchange of an order) -- it is made. The interval of I picture and the interval of P picture are freeand may change inside GOP.
[0012]A sequence (video sequence) comprises 1 or two or more GOP(s) with same image sizepicture rateetc.
[0013]As shown in drawing 2the syntax of the bit stream is specified for each class. For examplevarious kinds of contents and order of expressing with a sequence (video sequence) layer the pixel number HS beside synchronization code SSC which shows the start of a sequence layerand a pictureline number VS of the length of a pictureand the aspect ratio of a pixel intervalsuch as the index PR of the display rate of index PAR and a pictureare specified. The meaning of the cable address in drawing 2 is shown in drawing 3 - 7.
[0014]Drawing 8 is a block lineblock diagram of MPEG1 conventional encoder. The

MPEG1 conventional encoder 101 The motion prediction part 102 and the subtractor 103The discrete cosine transform machine (DCT) 104the quantizer 105and the variable-length-coding machine 106The buffer 107the inverse quantization device 108and the reverse discrete cosine transform machine (reverse DCT) 109The adding machine 110the delay circuit 111and the 1st frame buffer 112The 2nd frame buffer 113the mean value arithmetic circuit 114and the system control part 115It has the output data change over switch 116 which constitutes the multiplexing part of coding datathe reference image selecting switch 117 which chooses the reference image which takes differenceand the local decoded image input change over switch 118 which switches the input to each frame buffer 112113.

[0015]An inputted image is supplied to the motion prediction part 102. Inputted images are the digital luminance signal Y and the digital color-difference signal Cband a frame image that consists of Cr(s). The motion prediction part 102 can perform row **** in a frame unit while storing temporarily the frame image of two or more sheets. The motion prediction part 102 performs motion predictionand outputs the motion vector 102a. The macro block predicted to be motion prediction is predicting whether it being the closest to the thing of the position [macro block / of the same position in the frame used as a standard] however shifted. Although the decision criterion that it is near changes with algorithmsthe generation bit amount at the time of usually compressing is a value considered to become the smallest.

[0016]The procedure of encoding is explained based on the frame structure shown in drawing 9. In drawing 9the alphabet of the 1st character in a frame expresses a picture type. As for I picture and PP picture and B of I are B pictures. The number following a picture type shows the turn encoded. As mentioned aboveentry sequenced differs from the order of encoding.

[0017]Since the frame which can be used for prediction does not exist yetthe frame encoded first is assigned to I picture and codes only within a frame. At the time of encoding of I_0the system control part 115 controls the reference image selecting switch 117 in the position which supplies the data 0. Therebythe data of 0 is supplied to the reference image data input terminal 103a which takes the difference of the subtractor 103. Thereforethe pixel (pixel) data 102b of I picture outputted from the motion prediction part 102 does not receive an operation at all with the subtractor 103but the pixel data 102b of I picture are supplied to the discrete cosine transform part (DCT) 104 as it is. The discrete cosine transform part (DCT) 104 carries out orthogonal transformation of the pixel data 102b by 8x8 pixel unitsand outputs the conversion factor 104a. The conversion factor 104a is quantized with the quantizer 105. The quantized conversion factor 105a is changed into the variable length code 106a with the variable-length-coding machine 106. The variable length code 106a concerning a conversion factor is inputted into the buffer 107 via the output data change over switch 116and is supplied to a host computer etc. via this buffer 107.

[0018]The system control part 115 generates the coding data 115a of the layer

above a macro block layerThe output data change over switch 116 is switched to the output side of the system control part 115 from the output side of the variable-length-coding machine 106and the coding data 115a concerning a sequence layera GOP layera picture layerand a slice layer is supplied to the buffer 107.

[0019]The conversion factor 105a outputted from the quantizer 105 is supplied to the inverse quantization device 108and inverse quantization is carried out. Inverse orthogonal transformation of the conversion factor 108a decoded by inverse quantization is carried out with the reverse discrete cosine transform machine 109. The data 109a generated by inverse orthogonal transformation is supplied to one input terminal of the adding machine 110. Since the data of 0 is supplied to the input terminal of another side of the adding machine 110 via the delay circuit 111 in coding of I picturethe data 109a outputted from the reverse discrete cosine transform machine 109 is outputted as it iswithout the adding machine 110 receiving an operation at all.

[0020]Since the system control part 115 is controlling the local decoded image input change over switch 118 for exampleto the 1st frame buffer 112 side at the time of encoding of I_0the local decoded image of I_0 frame outputted from the adding machine 110 is stored in the 1st frame buffer 112.

[0021]The image data compressed with the discrete cosine transform machine 104 and the quantizer 105 is decoded herea decoded image is generatedand it stores in each frame buffer 112113 in order to use for the next inter frame prediction based on the coded frame data.

[0022]Nextthe case where the encoder of the B_1 shown in drawing 9 is carried out only using the backward prediction from I_0 is explained. In this casethe system control part 115 switches the reference image selecting switch 117 to the 1st frame buffer 112 side. The system control part 115 switches the local decoded image input change over switch 118 to an off position (position connected to neither of the frame buffers 112113).

[0023]While the system control part 115 makes the pixel data of the macro block which starts the frame B_1 from the motion prediction part 101 outputfrom the 1st frame memory 112. The pixel data of the rectangular area which shifted only a part to be specified by the same macro block position lost-motion vector 102a as the macro block position which the motion prediction part 101 is outputting are read. The pixel data 112a read according to the 1st frame memory 112 lost-motion vector 102a are supplied to the reference image input terminal 103a of the subtractor 103 via the reference image selecting switch 117. Thereforefrom the subtractor 103the difference data of the pixel data of the frame image of B_1 and the pixel data which performed the motion compensation to I picture coded previously is outputted. Orthogonal transformation is carried out with the discrete cosine transform machine 104it is quantized with the quantizer 105and this difference data is changed into a variable length code with the variable-length-coding machine 106and is accumulated via the output data change over switch 116 to the buffer 107.

[0024]Since B picture does not use it as a reference image of inter frame predictiongeneration of the local decoded image by the inverse quantization device 108 and reverse discrete cosine transform machine 109 grade is unnecessary. Thenthe system control part 115 is controlled not to perform generation operation of the local decoded image by the inverse quantization device 108 and reverse discrete cosine transform machine 109 grade.
[0025]Nextthe encoder of the B_2 shown in drawing 9 is carried out only using the backward prediction from I_0. This encode operation is the same as the case of encoding of **** of B_1.
[0026]NextP_3 shown in drawing 9 is encoded only using the forward prediction from I_0. In this casethe system control part 115 switches the reference image selecting switch 117 to the 1st frame buffer 112 side. The system control part 115 switches the local decoded image input change over switch 118 to the 2nd frame buffer 113 side.
[0027]While the system control part 115 makes the pixel data of the macro block which starts the frame P_3 from the motion prediction part 101 outputfrom the 1st frame memory 112. The pixel data of the rectangular area which shifted only a part to be specified by the same macro block position lost-motion vector 102a as the macro block position which the motion prediction part 101 is outputting are read. The pixel data 112a read according to the 1st frame memory 112 lost-motion vector 102a are supplied to the reference image input terminal 103a of the subtractor 103 via the reference image selecting switch 117. Thereforefrom the subtractor 103the difference data of the pixel data of the frame image of P_3 and the pixel data which performed the motion compensation to I picture coded previously is outputted. Orthogonal transformation is carried out with the discrete cosine transform machine 104it is quantized with the quantizer 105and this difference data is changed into a variable length code with the variable-length-coding machine 106and is accumulated via the output data change over switch 116 to the buffer 107.
[0028]Since the frame data of P picture is used for inter frame predictionlocal decoding is made. Inverse quantization of the quantized conversion factor 105a is carried out by the inverse quantization device 108inverse orthogonal transformation is carried out with the reverse discrete cosine transform machine 109and the data 109a decoded by inverse orthogonal transformation is supplied to one input terminal of the adding machine 110. The pixel data 112a read according to the 1st frame memory lost-motion vector 102a via the delay circuit 111 are supplied to the input terminal of another side of the adding machine 110. The time delay of the delay circuit 110 is set as a part for the processing time of coding / decryption loop formed with the discrete cosine transform machine 104the quantizer 105the inverse quantization device 108and the reverse discrete cosine transform machine 109. The image data made into the local decode data of difference data and a standard is added with the adding machine 110and local decoded image data is generated. The local decoded image data outputted from the adding machine 110 is stored in the 2nd frame buffer 113 where the estimated

image is not stored via the local decoded image input change over switch 118. Therebythe frame data of the local decoded image of P picture coded now is stored in the 2nd frame buffer 113.
[0029]NextB_4 shown in drawing 9 is encoded. Three kinds of prediction modes of the forward prediction from I_0the backward prediction from P_3and I_0 and the both-directions prediction from the average value of P_3 can be used for this encoding of B_4. It can be chosen whether which prediction mode is used for every macro block. The system control part 115 controls the reference image selecting switch 117 based on the prediction mode set up for every macro block. At the present timethe local decoded image data of I_0 is stored in the 1st frame buffer 112and the local decoded image data of P_3 is stored in the 2nd frame buffer 113respectively. Thereforethe reference image selecting switch 117 is controlled in the forward prediction mode from I_0 to choose the 1st frame buffer 112 side. The reference image selecting switch 117 is controlled in the backward prediction mode from P_3 to choose the 2nd frame buffer 113 side. The reference image selecting switch 117 is controlled in both-directions prediction mode to choose the output of the mean value arithmetic circuit 114. Herethe mean value arithmetic circuit 114 is constituted so that the average value of the output 112a of the 1st frame buffer 112 and the output 113a of the 2nd frame buffer 113 may be outputted. Operation of coding is the same as the case of B_1 mentioned above. The operation same also about B_5 as B_4 is made.
[0030]Encoding of a picture inputted by the repetition of such processing is performed. Herethe value with same pixel data of the inputted image outputted from the motion prediction part 102 and frame data which local decoding was carried out and was stored in the frame memory 112113 after being encoded does not become. In order that a main cause may make small data volume of the bit stream generated by encoding at the time of quantization by the quantizer 105It is because division of the orthogonal transformation output of the discrete cosine transform machine 104 will be done by the value of weighting called a quantizing scale and below a decimal point will be rounded off with it. Thereforein order for the local decoded image data stored in each frame buffer 112113 to converge on the value near inputted image data even if an inputted image is a still picture when the data volume of the bit stream generated is restricted smallit must pass through several frames.
[0031]
[Problem(s) to be Solved by the Invention]As explained abovein order to drop the relative redundancy of a time base direction on MPEG1the motion compensation was performedthe difference between images was takenand in order to drop the relative redundancy of space shaft orientations after thata definition and decoding logic of a bit stream are specified a discrete cosine transform and on the basis of the method which performs variable length coding.
[0032]Hereas a frame rateMPEG1 has prescribed eight kinds23.976242529.97305059.4and 60as the number of pictures (frame) per per secondas shown in the picture (a3) rate of drawing 5. Here the frame number

59.94 per per second The field rate of NTSC systemAs for the field rate of a PAL systemand 29.97the frame rate of a PAL system and 23.976 are four fifths of the rates of the frame rate of NTSC system the frame rate of NTSC systemand 25 50.

[0033]On the other handdepending on the use of a video conference systema monitoring camera systemetc.a frame rate is made lowand there is a demand of liking to make data volume small. In many casesit is known that data volume will become small in the direction which reduced the frame rate. Howevera frame rate cannot be made into 23.976 or less frames per second in the standard of MPEG1.

[0034]It was made in order that this invention might solve such a technical problemafter filling the frame rate of an MPEG standarda substantial frame rate is reducedand it aims at providing the art which can make data volume small.

[0035]

[Means for Solving the Problem]A video signal encoding method which starts this invention in order to solve said technical problem is generating a frame signal which shows that a frame is an identical image signaland inserting in a bit streamand reduces a substantial frame rate.

[0036]A coding video signal device concerning this invention is having a frame copying means which generates a frame signal which shows that a frame is an identical image signaland is inserted in a bit streamand reduces a substantial frame rate.

[0037]

[Embodiment of the Invention]Hereafterthis embodiment of the invention is described based on an accompanying drawing. Drawing 10 is a block lineblock diagram of the coding video signal device based on MPEG1 standard concerning this invention. The coding video signal device 1 based on MPEG1 standardThe motion prediction part 2the subtractor 3and the discrete cosine transform machine (DCT) 4The quantizer 5the variable-length-coding machine 6the buffer 7and the inverse quantization device 8The reverse discrete cosine transform machine (reverse DCT) 9the adding machine 10and the delay circuit 11The 1st frame buffer 12the 2nd frame buffer 13and the mean value arithmetic circuit 14The output data change over switch 16 which constitutes the system control part 15 and the multiplexing part of coding dataIt consists of the reference image selecting switch 17 which chooses the reference image which takes differencethe local decoded image input change over switch 18 which switches the input to each frame buffer 112113and the copy stream generator 19 which constitutes a frame copying means. The difference with MPEG1 conventional encoder shown in drawing 8 is a point provided with the copy stream generator 19.

[0038]An inputted image is supplied to the motion prediction part 2. Inputted images are the digital luminance signal Y and the digital color-difference signal Cband a frame image that consists of Cr(s). The motion prediction part 2 performs row **** in a frame unit while storing temporarily the frame image of two or more sheets. The motion prediction part 2 performs motion predictionand outputs the motion vector 2a.

[0039]The procedure of the usual encoding which does not use a copy frame is

explained based on the frame structure shown in drawing 9. The frame encoded first is I picture and codes only within a frame. At the time of encoding of I_0the system control part 15 controls the reference image selecting switch 17 in the position which supplies the data 0. Therebythe data of 0 is supplied to the reference image data input terminal 3a which takes the difference of the subtractor 3. Thereforepixel (pixel) data 2b of I picture outputted from the motion prediction part 2 does not receive an operation at all with the subtractor 3but pixel-data 2b of I picture is supplied to the discrete cosine transform part (DCT) 4 as it is. The discrete cosine transform part (DCT) 4 carries out orthogonal transformation of the pixel-data 2b by 8x8 pixel unitsand outputs the conversion factor 4a. The conversion factor 4a is quantized with the quantizer 5. The quantized conversion factor 5a is changed into the variable length code 6a with the variable-length-coding machine 6. The variable length code 6a concerning a conversion factor is inputted into the buffer 7 via the output data change over switch 6and is supplied to a host computer etc. via this buffer 7.
[0040]The system control part 5 generates the coding data 5a of the layer above a macro block layerThe output data change over switch 16 is switched to the output side of the system control part 15 from the output side of the variable-length-coding machine 6and the coding data 15a concerning a sequence layera GOP layera picture layerand a slice layer is supplied to the buffer 7.
[0041]The conversion factor 5a outputted from the quantizer 5 is supplied to the inverse quantization device 8and inverse quantization is carried out. Inverse orthogonal transformation of the conversion factor 8a decoded by inverse quantization is carried out with the reverse discrete cosine transform machine 9. The data 9a generated by inverse orthogonal transformation is supplied to one input terminal of the adding machine 10. Since the data of 0 is supplied to the input terminal of another side of the adding machine 10 via the delay circuit 11 in coding of I picturethe data 9a outputted from the reverse discrete cosine transform machine 9 is outputted as it iswithout the adding machine 10 receiving an operation at all.
[0042]Since the system control part 15 is controlling the local decoded image input change over switch 18 for exampleto the 1st frame buffer 12 side at the time of encoding of I_0the local decoded image of I_0 frame outputted from the adding machine 10 is stored in the 1st frame buffer 12.
[0043]The image data compressed with the discrete cosine transform machine 4 and the quantizer 5 is decoded herea decoded image is generatedand it stores in each frame buffers 12 and 13 in order to use for the next inter frame prediction based on the coded frame data.
[0044]Nextthe case where the encoder of the B_1 shown in drawing 9 is carried out only using the backward prediction from I_0 is explained. In this casethe system control part 15 switches the reference image selecting switch 17 to the 1st frame buffer 12 side. The system control part 15 switches the local decoded image input change over switch 18 to an off position (position connected to neither of the frame buffers12 nor 13).

[0045]While the system control part 15 makes the pixel data of the macro block of the frame B_1 output from the motion prediction part 1from the 1st frame memory 12. The pixel data of the rectangular area which shifted only a part to be specified by the same macro block position lost-motion vector 2a as the macro block position which the motion prediction part 1 is outputting are read. The pixel data 12a read according to the 1st frame memory 12 lost-motion vector 2a are supplied to the reference image input terminal 3a of the subtractor 3 via the reference image selecting switch 17. Thereforefrom the subtractor 3the difference data of the pixel data of the frame image of B_1 and the pixel data which performed the motion compensation to I picture coded previously is outputted. Orthogonal transformation is carried out with the discrete cosine transform machine 4it is quantized with the quantizer 5and this difference data is changed into a variable length code with the variable-length-coding machine 6and is accumulated via the output data change over switch 16 to the buffer 7.
[0046]Since B picture does not use it as a reference image of inter frame predictiongeneration of the local decoded image by the inverse quantization device 8 and reverse discrete cosine transform machine 9 grade is unnecessary. Thenthe system control part 15 is controlled not to perform generation operation of the local decoded image by the inverse quantization device 8 and reverse discrete cosine transform machine 9 grade.
[0047]Nextthe encoder of the B_2 shown in <u>drawing 9</u> is carried out only using the backward prediction from I_0. This encode operation is the same as the case of encoding of **** of B_1.
[0048]NextP_3 shown in <u>drawing 9</u> is encoded only using the forward prediction from I_0. In this casethe system control part 15 switches the reference image selecting switch 17 to the 1st frame buffer 12 side. The system control part 15 switches the local decoded image input change over switch 18 to the 2nd frame buffer 13 side.
[0049]While the system control part 15 makes the pixel data of the macro block which starts the frame P_3 from the motion prediction part 1 outputfrom the 1st frame memory 2. The pixel data of the rectangular area which shifted only a part to be specified by the same macro block position lost-motion vector 2a as the macro block position which the motion prediction part 1 is outputting are read. The pixel data 12a read according to the 1st frame memory 12 lost-motion vector 2a are supplied to the reference image input terminal 3a of the subtractor 3 via the reference image selecting switch 17. Thereforefrom the subtractor 3the difference data of the pixel data of the frame image of P_3 and the pixel data which performed the motion compensation to I picture coded previously is outputted. Orthogonal transformation is carried out with the discrete cosine transform machine 4it is quantized with the quantizer 5and this difference data is changed into a variable length code with the variable-length-coding machine 6and is accumulated via the output data change over switch 16 to the buffer 7.
[0050]Since the frame data of P picture is used for inter frame predictionlocal decoding is made. Inverse quantization of the quantized conversion factor 5a is

carried out by the inverse quantization device 8inverse orthogonal transformation is carried out with the reverse discrete cosine transform machine 9and the data 9a decoded by inverse orthogonal transformation is supplied to one input terminal of the adding machine 10. The pixel data 12a read according to the 1st frame memory lost-motion vector 2a via the delay circuit 11 are supplied to the input terminal of another side of the adding machine 10. The time delay of the delay circuit 10 is set as a part for the processing time of coding / decryption loop formed with the discrete cosine transform machine 4the quantizer 5the inverse quantization device 8and the reverse discrete cosine transform machine 9. The image data made into the local decode data of difference data and a standard is added with the adding machine 10and local decoded image data is generated. The local decoded image data outputted from the adding machine 10 is stored in the 2nd frame buffer 13 where the estimated image is not stored via the local decoded image input change over switch 18. Therebythe frame data of the local decoded image of P picture coded now is stored in the 2nd frame buffer 13.
[0051]NextB_4 shown in drawing 9 is encoded. Three kinds of prediction modes of the forward prediction from I_0the backward prediction from P_3and I_0 and the both-directions prediction from the average value of P_3 can be used for this encoding of B_4. It can be chosen whether which prediction mode is used for every macro block. The system control part 15 controls the reference image selecting switch 17 based on the prediction mode set up for every macro block. At the present timethe local decoded image data of I_0 is stored in the 1st frame buffer 12and the local decoded image data of P_3 is stored in the 2nd frame buffer 13respectively. Thereforethe reference image selecting switch 17 is controlled in the forward prediction mode from I_0 to choose the 1st frame buffer 12 side. The reference image selecting switch 17 is controlled in the backward prediction mode from P_3 to choose the 2nd frame buffer 13 side. The reference image selecting switch 17 is controlled in both-directions prediction mode to choose the output of the mean value arithmetic circuit 14. Herethe mean value arithmetic circuit 14 is constituted so that the average value of the output 12a of the 1st frame buffer 12 and the output 13a of the 2nd frame buffer 13 may be outputted. Operation of coding is the same as the case of B_1 mentioned above. The operation same also about B_5 as B_4 is made. Encoding of a picture inputted by the repetition of such processing is performed.
[0052]Nextthe copy of a frame is explained. The coding video signal device 1 shown in drawing 10 is a point provided with the copy stream generator 19and is different from MPEG1 conventional encoder shown in drawing 8. If the copy stream output requirement 15b is supplied from the system control part 15the copy stream generator 19 is constituted so that the code word bit stream 19a concerning the copy in which it is shown that a frame is the frame and identical image which were coded previously may be outputted. When generating the copy stream output requirement 15bthe system control part 15 is controlled so that the output data change over switch 16 switches to the code word bit stream 19a side. Thereforethe code word bit stream 19a outputted from the copy stream generator

19 is supplied to the buffer 7 via the output data change over switch 16and is outputted to other device side which are not illustrated via this buffer 7or a communication line.

[0053]It may be made to provide the function of a copy stream generator in the system control part 15without forming the copy stream generator 19 as independent hardware. When the function of a copy stream generator is provided in the system control part 15the system control part 15 outputs the code word bit stream 19a concerning the copy of a frame into the coding data 15a concerning a sequence layera GOP layera picture layerand a slice layer.

[0054]In the frame structure shown in drawing 9the case where all the B pictures are copied in backward prediction mode is explained. Drawing 11 is an explanatory view showing an example of the frame structure containing a copy frame. In drawing 11the arrow shown by the thick line is a portion using a copy. If this copy frame is specifiedthe picture (frame) of B_1 and B_2 will become the same as the picture (frame) of I_0. The picture of B_4 and B_5 becomes the same as P_3andas for P_6B_13and B_14B_7 and B_8 become the same as P_12.

[0055]As a resultif the coded image data including the code word bit stream 19a concerning a copy is decodedas shown in drawing 12three pictures of I_0 rank second continuouslyIt becomes a form where three frames and P_6 picture continued in P_3 pictureand three frames and P_12 picture continued by three framesrespectively in three frames and P_9 picture. Thereforewhen an inputted image is NTSC systemin the standard top of MPEG1a frame rate will use 29.97 frames per secondbut a substantial frame rate can be made into 9.99 frames per second of 1/3 of 29.97 frames per second.

[0056]Drawing 13 is a list in which the contents of the code word bit stream concerning the copy at the time of making a copy destination into B picture are shown. When using the copy of the picture coded previously without coding B picture regularlythe code word bit stream 19a concerning the copy explained below from the copy stream generator 19 is outputted.

[0057]In the data structure of MPEG1as shown in drawing 2it is necessary to send PSCTRPCTVD (BF)FPFVFFFPBVBFEBPBAetc. by a picture layer.

[0058]HerePSC (picture start code) is a synchronization code of the beginning of a picture layerand the bit length is 32 bits. TR (temporal refrence) is a value which shows display orderand the bit length is 10 bits. This TR is reset with the head of GOP. When TR exceeds 1024the surplus value of 1024 is used. PCT (picture codingtype) is a value which shows the coding mode (picture type) of a picture. The code of the triplet is specified as the coding mode of this picture is shown in drawing 6 (a5). VD (BF) is the data volume which should be stored to the bit stream buffer to the decoding start of the pictureand the bit length is 16 bits. FPFV (full pel forward vector) is a code the accuracy of a motion vector indicates a pixel unit or a half a pixel unit to be at the time of B or P picture existenceand the bit length is 1 bit. FF (forward f) is a code which shows the search range of the motion vector to the frontand the bit length is a triplet. FPBV (full pel bakward vector) is a code the accuracy of a motion vector indicates a pixel unit or a half a

pixel unit to be at the time of B picture existenceand the bit length is 1 bit. BF (bakward f) is a code which shows the search range of the motion vector to backand the bit length is a triplet. EBP (extra bitpicture) is a flag which shows the existence of an extra information pictureand the bit length is 1bitxn. BA (byte alingn) is dummy bits of a byte alignment sake.

[0059]In the data structure of MPEG1as shown in drawing 2a picture layer needs to send out SSCQSElectronic Broking Systemsetc.and it is necessary to send out MBAIMBTYPEMHBMVBMBESCetc. in a macro block layer further.

[0060]HereSSC (slice start kode) is a synchronization code which a slice layer begins and shows **and the bit length is 32 bits. QS (quantize scale) is data which gives the quantization width by which slice use is carried outand the bit length is 5 bits. Electronic Broking Systems (extra bit slice) is a flag which shows the existence of an extra information sliceand the bit length is 1bitxn.

[0061]MBAI (macroblock address increment) is a variable length code which shows several +1 of the skip MB before the MBand the number of bits is 1-11 bits. MBTYPE (macroblock type) is a variable length code which shows the coding mode of the MBand the number of bits is 1-8 bits. MHB (motionhorizontal backward)It existswhen MB types are back and both-directions predictionand the difference of the horizontal component of the back motion vector of the MB and a front vector is coded in the table of VLC expressed with backward fand the bit length is 1-14 bits. MVB (motionvertival backward)It existswhen MB types are back and both-directions predictionand the difference of the vertical component of the back motion vector of the MB and a front vector is coded in the table of VLC expressed with backward fand the bit length is 1-14 bits. MBESC (macroblock escape) is a code equivalent to 33 skip macro blocksand the bit length is 11 bits.

[0062]Thereforein the picture layerthe copy stream generator 19 is considered as the composition which sends out the following bit streams 19aas shown in drawing 13. First32-bit PSC(picture startcode)0000000000000000000 0000100000000 is sent out. Next10-bit TR (temporal refrence) is sent out. This TR is not the order of encoding and is taken as the number which let the number of the entry sequenced within that GOP of a video source pass from 0. Nextthe code which shows B picture by PCT(picture coding type) 011 of a triplet is sent out. Next16-bit VD (vdv delay) is sent out. NextFPFVFFFPBVand BF send out the information on a motion vector one by one. Next1-bit EBP (extra bit picture) is sent out. and the last of a picture layer -- the next -- 2 bytes of code 00 for taking the by tor lamento for sending out the slice start code in a slice layer is sent out.

[0063]and the copy stream generator 19 is shown in drawing 13 -- as -- a picture layer -- what -- **** -- it has composition which sends out the following bit streams 19a. First32-bit SSC(slice start code) 0000000000000000000 0000100000001 is sent out. Nextthe data QS (quantize scale) which gives the quantization width of 5 bits is sent out. Nextthe flag Electronic Broking Systems (extrabit slice) which shows the existence of a 1-bit extra information slice is sent out.

[0064]The copy stream generator 19 sends out MBAI (macroblock address increment) first in a macro block layeras shown in drawing 13. Nextthe data of 1 macro-block eye is sent out. Firstthe code of the triplet of 010 which shows for exampleB picture as MBTYPE (macroblock type) is sent out. Subsequentlywhile MHBMVB sends out that the values of a motion vector are (00)it sends out that all the quantized discrete cosine transform coefficients are 0. And skip macro block specification even of the macro block in front of [of the last macro block] one is carried out henceforth [2 macro-block eye]. He is trying to specify by sending out MBESC(macroblock escape)00000001000 [11-bit] here. Since MBESC is equivalent to the skip macro block for 33 piecesrequired number repetition sending out of the MBESC is carried out. The number of MBESC is set to total (macro block number-2) / 33. Nextthe last macro block is specified by MBAI. The value of MBAI (macroblock address increment) of the last macro block is %(total macro block number-1) 33. Hereit is shown that %33 asks for the surplus which did division by 33. And while sending out that the values of a motion vector are (00) by MHB and MVB also about the last macro blockit sends out that all the quantized discrete cosine transform coefficients are 0. And the bit for a byte aryne (dummy bits) is sent out for the following start code.
[0065]As mentioned abovealthough the case where it copied to B picture was explained and carried outthe same thing can be performed to P picture. The list of code word bit streams concerning the copy at the time of making a copy destination into P picture is shown in drawing 14.
[0066]Even if it copies to B picture and copies to P picturethe bit quantity of the bit stream concerning the copy per one picture is the same. When decoding by software is assumedit is desirable to set B picture which can omit decoding as a copy destination. When processing does not meet the deadline in fixed time in the case of software decodingit is for carrying out processing which reads and throws away datawithout performing decoding of B picture. Since in the case of P picture the decoded frame is used in order to decode other framescan read data and it cannot be thrown away.
[0067]The data volume of the bit stream which starts a copy to 352 pixels wide and a 240-pixel-long frame is about 240 bits. This value is not filled to 0.021% as compared with 1.152 megabits per second of rates of the bit stream currently used by the video CD etc. Since about 20 in the image data of NTSC of per second about 30 frames are transposed to the bit stream concerning a copy in the example shown in drawing 11The data volume of the bit stream concerning the copy for about 20 frames is about 0.42% of the bit rate of 1.152 megabits per second.
[0068]As an example when it applies to other fieldsit assumes encoding by 65536 kilobits per second. If the frame size at this time shall be 160 pixels wide and 112 pixels longthe data volume of the bit stream concerning a copy will be about 160 bits. The percentage of the data volume of the bit stream concerning the copy for 20 frames occupied to total bit quantity is 4.9%.
[0069]As explained abovea frame rate smaller than the frame rate specified by

MPEG1 is realizable by putting in a copy frame periodically.
[0070]It may be made to insert a copy frame if needed. When transmitting the bit stream which was able to perform digital image compression using communication in real timethe circuit is crowded and transmission may be impossible in the desired bit rate. When sucha generation bit amount can be pressed down by using a copy frameandas a resultthe continuity of data can be maintained.
[0071]The throughput of a microprocessor can increase by leaps and boundsand decoding processing of the bit stream of MPEG1 can be performed now by software these days. Howeversince the throughput of a microprocessor will be taken by decoding processing during the decoding processing in softwareit is the hindrance of other work. Thensince it is not necessary to perform the inverse quantization at the time of decoding processing (elongation processing of the compressed image data)and a reverse discrete cosine transform (reverse DCT)the burden of a processor can be made to ease by reducing the frame rate by copy. Almost needs to be processed to that frame by showing clearly that this frame is a copy frame in a bit stream. Since the copy frame inserted into the bit stream can judge that it is a copy frame easily from the data structureit needs to process almost to a copy frame.
[0072]Nextother examples of composition of the coding video signal device concerning this invention are explained based on drawing 15. The coding video signal device 21 shown in drawing 15 constitutes the frame copying means with the quantization data change over switch 22 and the motion-vector-data change over switch 23. He is trying for the output data change over switch 24 to switch whether the output 6a of the variable-length-coding machine 6 is chosenor the output 15a of the system control part 25 is chosen.
[0073]The quantization data change over switch 22 is interposed between the input side of the variable-length-coding machine 6and the quantizer 5. This quantization data change over switch 22 is considering whether the input data to the variable-length-coding machine 6 is considered as the output (quantized conversion factor) 5a of the quantizer 5or it is considered as zero data as the composition switched by control of the system control part 25.
[0074]The motion-vector-data change over switch 23 is considering whether the motion vector supplied to each part is made into the motion vector 2a outputted from the motion prediction part 2or it carries out as the composition switched by control of the system control part 25 0.
[0075]When the system control part 25 performs the usual encode operationWhile switching the quantization data change over switch 22 so that the output (quantized conversion factor) 5a of the quantizer 5 may be supplied to the variable-length-coding machine 6it moves so that the motion vector 2a outputted from the motion prediction part 2 may be supplied to each partand the vector data change over switch 23 is switched.
[0076]When the system control part 25 copies a frame and generates a copy bit streamWhile switching the quantization data change over switch 22 so that the data inputted into the variable-length-coding machine 6 may be set to 0it moves

so that a motion vector may be set to 0and the vector data change over switch 23 is switched.

[0077]Thusa coding block can become the same as that of a prediction blockand can make the data of a macro block layer skip by setting a motion vector to 0 and setting a quantization output to 0 compulsorilywithout sending what. Thereforewhile the amount of coding data to send out becomes smalla substantial frame rate can be reduced.

[0078]

[Effect of the Invention]The video signal encoding method and coding video signal device which are applied to this invention as explained aboveSince the code word bit stream which shows that it is the frame and identical image which were coded previously was inserted to the frame which culls outafter satisfying the conditions of the frame rate on a standarda substantial frame rate can be reduced.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is an explanatory view showing the data structure of MPEG1.

[Drawing 2]It is an explanatory view showing the bit stream structure of MPEG1.

[Drawing 3]It is an explanatory view showing the bit stream structure of MPEG1.

[Drawing 4]It is an explanatory view showing the bit stream structure of MPEG1.

[Drawing 5]It is an explanatory view showing the bit stream structure of MPEG1.

[Drawing 6]It is an explanatory view showing the bit stream structure of MPEG1.

[Drawing 7]It is an explanatory view showing the bit stream structure of MPEG1.

[Drawing 8]It is a block lineblock diagram of MPEG1 conventional encoder.

[Drawing 9]It is an explanatory view showing an example of the procedure of encoding.

[Drawing 10]It is a block lineblock diagram of the coding video signal device concerning this invention.

[Drawing 11]It is an explanatory view showing an example of the frame structure containing a copy frame.

[Drawing 12]It is an explanatory view showing how whose apparent frame when a copy frame is used is visible.

[Drawing 13]It is a list in which the contents of the code word bit stream concerning the copy at the time of making a copy destination into B picture are shown.

[Drawing 14]It is a list in which the contents of the code word bit stream concerning the copy at the time of making a copy destination into P picture are shown.

[Drawing 15]It is a block lineblock diagram of other coding video signal devices concerning this invention.

[Description of Notations]

1 and 21 A coding video signal device2 motion prediction parts4 discrete-cosine-

transform machine5 A quantizer and 6 A variable-length-coding machine and 7 A buffer and 8 Inverse quantization device9 A reverse discrete cosine transform machine1525 system control parts1624 output-data change over switch19 copy stream generators22 quantization-data change over switch23 motion-vector-data change over switch